BEFORE THE

Federal Communications Commission

WASHINGTON, D.C.

In the Matter of	)	
Wireless E911 Location Accuracy Requirements	)	PS Docket No. 07-114
Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems	)	CC Docket No. 94-102
Association of Public-Safety Communications Officials-International, Inc. Request for Declaratory Ruling	)	
911 Requirements for IP-Enabled Service Providers	)	WC Docket No. 05-196

COMMENTS OF TRUEPOSITION, INC.

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COMMENTS OF TRUEPOSITION, INC.

TruePosition, Inc., hereby responds to the second phase of the above-captioned Notice of Proposed Rulemaking ("*Notice*") addressing important issues of E911 accuracy.

TruePosition is a leading provider of wireless location solutions and technology. Its Uplink Time Difference of Arrival ("U-TDOA") system is the principal network-based location technology deployed in the United States.

I. INTRODUCTION AND SUMMARY

As TruePosition indicated in its comments in the first phase of this proceeding, it will provide its perspective on the technical capabilities of location technology, on the opportunities for improvement in the technology, and on possible adjustments in regulation predicated on technological developments. Before doing so, one preliminary and overarching observation is appropriate in light of many of the comments submitted in the first phase of this proceeding.

Many of the comments pointed out that no existing or anticipated technology would achieve the Commission's accuracy standards in *every* case. That undoubtedly is true, but it also is irrelevant. Perfection is not achievable, but it also is not, and should not be understood to be, the Commission's true aim in this or any other proceeding. As the Commission said in initiating the *Notice*, "At its core, the goal of our E911 rules is to provide meaningful automatic location identification information that permits first responders to render aid, regardless of the technology or platform employed."[1] From the perspective of public policy, in this case as well as others, the issue is whether changes in requirements will produce material improvements, weighing relevant costs against relevant benefits. In this case, there is a very substantial basis for the conclusion that improvements are achievable. Whether they warrant the investment is the principal policy judgment the Commission must make.

As to the issues raised by the Commission in the *Notice*, TruePosition's comments make the following points:

- U-TDOA technology is able to provide accurate location estimates for calls placed within buildings as well as calls placed out of doors in urban and suburban locales. The accuracy of estimates in these circumstances, as well as in rural locales, would be improved with additional investment in existing technology -- essentially with the addition of more location measurement units ("LMUs") and with the addition of angle of arrival ("AOA") technology. There is no developmental risk associated with these types of improvements. It simply is a matter of the amount of investment considered appropriate to secure improved location estimates.

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[1] *Wireless E911 Location Accuracy Requirements*, Notice of Proposed Rulemaking, 22 FCC Rcd 10604 ¶ 6 (2007) ("*Notice*").

- The only development that promises significant improvement in location estimates in all circumstances is a hybrid technology consisting of U-TDOA and A-GPS. TruePosition does not believe that there is any significant developmental risk associated with the creation of this hybrid. The network functionality is achievable -- we believe reliably so -- in approximately 18 months. Extensive penetration of GPS-enabled handsets is likely to take longer. A U-TDOA + A-GPS hybrid has the ability to overcome many of the limitations of handset technology in urban and in-building settings and of network technology in rural settings. Other variants of hybrid handset-network technology will not produce significant performance improvements.
- Location testing protocols should not be defined in detail by the Commission. Rather, the Commission should establish appropriate requirements -- such things as time and confidence intervals and percentage of indoor calls reflecting actual usage -- and permit industry and public safety agencies to develop appropriate testing procedures.
- Monitoring and evaluation of accuracy and maintenance reports should be the responsibility of the Commission and perhaps a third party auditor, rather than of the public safety answering points ("PSAPs"). The reports should be available to both the PSAPs and the public. TruePosition believes that many PSAPs are unlikely to have the resources necessary to evaluate accuracy and maintenance data on an ongoing basis. As a result, a centralized approach to the review of these reports is likely to provide advantages of both efficiency and expertise to the process.
- E911 location service should be available to roamers. The benefits of location estimates for emergency wireless calls are particularly pronounced where callers are unfamiliar with the locale.

- Whether a single accuracy standard should be adopted is a function of the Commission's decisions with respect to technology. If a specific hybrid technology is mandated, the existence of separate network and handset accuracy requirements would be an anachronism *once the transition is complete.* If a hybrid technology is not mandated and the Commission seeks to apply accuracy standards at the PSAP level, it should maintain the existing standards. However, it should recognize that network-based technologies will not be able to meet the standard in many rural areas and that handset-based technologies will not be able to meet the standard in many urban areas. Whether it is appropriate to maintain a single accuracy standard for any particular technology notwithstanding differences in topography, density of cultural features, and levels of population should be informed by PSAP needs.

II. REVIEW OF LOCATION TECHNOLOGIES

There are several individual and hybrid location technologies which can be considered for E911 compliance, including U-TDOA, U-TDOA + A-GPS, A-GPS, and AFLT + A-GPS. We will address each of these in turn.

In the first phase of this proceeding, AT&T and others suggested that some form of testbed to gauge the qualities of alternative technologies would be beneficial.[2] Similarly, the *Notice* indicated that the Commission's staff would conduct studies into both hybrid technologies and the performance of different technologies in locating calls placed from inside buildings.[3] TruePosition will provide its full participation and cooperation in connection with any technical

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[2] *See* Comments of AT&T at 5-6. For purposes herein, unless otherwise noted, all citations are to filings made in PS Docket No. 07-114 on July 5, 2007.

[3] *Notice* ¶ 19.

tests of this nature mounted by the Commission or by industry under the Commission's auspices.[4]

A. U-TDOA

U-TDOA has been deployed by several wireless operators using the GSM standard for wireless communication. U-TDOA locates wireless devices by measuring the time difference of arrival of signals transmitted by the wireless devices. U-TDOA does not require changes to mobile handsets, and can be used to locate all phones connected to the network once it is deployed. U-TDOA is based on location using high power terrestrial signals. With the use of high levels of signal processing, U-TDOA can derive good location estimates, including for signals which have had to propagate through high loss paths, including those from handsets indoors and from urban environments, places where satellite systems often fail to perform.

U-TDOA performance varies within each type of environment based upon many factors, such as cell site density, building density, terrain, or the specific type of building. Also, U-TDOA LMUs are often deployed on only a fraction of sites in urban and suburban areas to reduce overall cost while still meeting network level requirements of 100 meter 67 percent of occurrences, 300 meter 95 percent of occurrences.

The typical performance of U-TDOA, based upon TruePosition's extensive deployment experience, is shown in Table 1. The performance assumes appropriate levels of investment in the technology. Very importantly, it also assumes appropriate levels of investment in maintenance. The cost of maintaining U-TDOA systems is not trivial, but it is essential in enabling the technology to perform at optimal levels.

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[4] As TruePosition has indicated, the issues implicated in this proceeding "lend themselves to a forum of industry and public safety stakeholders" that would enable the exchange of relevant information and inform the Commission's efforts to develop appropriate rules. Comments of TruePosition at 7.

Table 1

Metric	Metric Definition	Rural Outdoor	Suburban Outdoor	Urban Outdoor	Dense Urban Outdoor	Indoor Low Penetration	Indoor High Penetration
Accuracy 67 percent (m)	67th percentile error in meters	50 to 500+	65	65	65	77	90
Accuracy 95 percent (m)	95th percentile error in meters	300 to 1000+	180	180	180	210	270

U-TDOA requires that receivers at several locations, usually co-located with cell sites, be able to detect and measures signals. In areas with significant population density such as in urban, suburban and dense rural scenarios (areas where the cell site spacing is less than or equal to 15 miles), as Table 1 reflects, U-TDOA is able to meet or exceed the 100 meter/300 meter requirements for network based solutions. However, in areas where the cell sites spacing is greater than 15 miles, where there is difficult terrain (large hills, mountains), or where the cell site geometry is in a line providing coverage along only a major road (sometimes referred to as a "string of pearls" configuration), U-TDOA has challenges meeting the accuracy requirement for network based solutions.

Several techniques exist for improving accuracy in these areas where U-TDOA is challenged.

First, TruePosition has developed a software feature for improving accuracy which is available to TruePosition's customers in the current release of TruePosition software. The software filters out probable outliers among multiple location estimates, improving the quality of the estimates presented to the PSAP.

Second, AOA can be deployed on existing sites to supplement the performance in areas where U-TDOA alone would not meet a given accuracy requirement. A string of pearls is an excellent example of where AOA could significantly improve performance. While to date TruePosition has not been required to supply AOA equipment to meet accuracy requirements, it has deployed AOA for trial and First Office Application purposes. TruePosition support of AOA is available in the product release currently provided customers.

Third, U-TDOA can be deployed on additional cell sites. This could include existing sites used for voice and data service, but not yet equipped with U-TDOA technology. It also could include sites accessed through cooperation with other operators which may already have antennas which receive the appropriate band deployed, or operators which have already deployed LMUs for U-TDOA and are willing to share LMU resources. It also could include deployment of cell site antennas and related structures solely for the support of U-TDOA. The current release of the TruePosition product provided to customers supports sharing of antennas and location equipment across systems and networks.

Based on experience in deploying 75,000 LMUs across both large and small networks, TruePosition has performed an analysis with respect to the fraction of PSAPs over which the deployed solutions would meet a PSAP level accuracy requirement. TruePosition has also estimated the fraction of PSAPs which could be compliant with a PSAP level FCC requirement based on a progression of the above improvements.

Actual location accuracy test data across several hundred PSAP areas was analyzed. The test data was filtered by PSAP boundaries to obtain individual sets of test data for each PSAP area. The test data was analyzed to verify that for each PSAP area, the set of test calls is consistent with the Office of Engineering and Technology Bulletin 71 ("OET-71") and Emergency Services Interconnection Forum ("ESIF") testing guidelines. Specifically, each PSAP was analyzed to ensure there was an adequate number of test calls, and that the test calls were properly distributed across each PSAP. If a PSAP level requirement (location errors less than 100 meters for 67 percent of calls, and less than 300 meters for 95 percent of calls) were put in place today, the U-TDOA system deployed would be compliant in 70-75 percent of the PSAPS where E911 service is offered today. These PSAPs, where the U-TDOA solution would be compliant at the PSAP level, include most population centers, which service about 90 percent of all E911 calls across those networks.

Enabling the previously noted software enhancements will improve accuracy. We estimate that 80-85 percent of PSAPs will be brought into compliance with a PSAP level requirement, with these compliant PSAPs covering 90-95 percent of all E911 calls.

In addition to the above software feature, more PSAPs could be brought into compliance by augmenting a number of U-TDOA sites with AOA, or deploying additional U-TDOA sites. This would bring the percent of compliant PSAPS to about 90 percent, with 98-99 percent of E911 calls being placed within these PSAPs. We estimate that approximately 5 percent of cell sites would need to be augmented, either by adding AOA to existing U-TDOA installations or by an initial installation of U-TDOA.

The remaining 10 percent of PSAPs would require dramatic deployment of AOA and additional U-TDOA sites to achieve compliance. While this is possible, it would benefit only 1-

2 percent of all E911 calls at an extremely large expense. Instead, rolling out an A-GPS + U-TDOA hybrid would provide the optimal performance in these areas, and would improve the accuracy significantly in other areas with an unblocked sky, or even a partially blocked sky, to the point where a vast majority of PSAPs could meet a 50 meter 67 percent and 150 meter 95 percent location accuracy requirement, with these PSAPs accounting for the vast majority of the E911 calls.

This analysis is based on a recent snapshot of carrier deployments. In general, these deployments tend to encompass urban and suburban areas. Many rural areas remain to be deployed. As those deployments occur, we anticipate a higher percentage of PSAPs will fall into categories requiring additional effort to bring them into compliance. The percentage of 911 calls occurring in compliant PSAPs will not change significantly.

B. U-TDOA + A-GPS Hybrid

U-TDOA + A-GPS hybrid location technology combines the benefits of the reliable and accurate urban and indoor performance of U-TDOA with the reliable and accurate rural performance of A-GPS, while allowing each technology to enhance the other in all areas. U-TDOA alone has an accuracy of 65-90 meters 67 percent of occurrences and 180-270 meters 95 percent of occurrences in most dense urban, urban, and suburban environments. Accuracy varies as a function of terrain, building density and cell density. U-TDOA accuracy in rural areas varies from 50 meters to several thousand meters, depending upon terrain, cell site density and geometry. Based upon TruePosition's analysis, a U-TDOA + A-GPS hybrid would provide very significant improvements in accuracy, as shown in Table 2.

Table 2

Metric	Metric Definition	Rural Outdoor	Suburban Outdoor	Urban Outdoor	Dense Urban Outdoor	Indoor Low Penetration	Indoor High Penetration
Accuracy 67 percent (m)	67th percentile error in meters	14	20	20	50	40	70
Accuracy 95 percent (m)	95th percentile error in meters	42	60	60	150	120	210

A U-TDOA + A-GPS hybrid will provide the best performance of any individual technology or any hybrid available today or in the foreseeable future. TruePosition anticipates that this hybrid technology would meet 100 meter 67 percent, 300 meter 95 percent requirements for virtually all PSAPs. TruePosition believes that a 50 meter 67 percent, 150 meter 95 percent requirement would be met in the vast majority of PSAPs with this hybrid technology, assuming testing was performed with sound engineering practices, and with an appropriate level of in-building testing proportional to the fraction of indoor E911 calls expected in each environment.

TruePosition is planning to offer the network support for U-TDOA + A-GPS hybrid technology. This software can be provided and deployed within 18 months. Because TruePosition does not provide mobile phones and is not a wireless operator, it is not able to predict how long it would take for GSM operators to begin shipping A-GPS enabled phones en

masse, nor how long it would take to reach desirable penetration rates. However, based upon the difficulty that carriers deploying A-GPS technology have encountered in reaching the 95 percent requirement set forth in 47 C.F.R. § 20.18(g), TruePosition believes that significant penetration of A-GPS-enabled handsets would take at least three years. As a result, TruePosition would be able to provide the network support for a U-TDOA + A-GPS hybrid well before it is needed to support a significant penetration of handsets.

TruePosition's U-TDOA + A-GPS hybrid is not limited to the GSM air interface. It also is the only satisfactory approach for the CDMA air interface. Verizon's comments acknowledge that the AFLT + A-GPS hybrid it deploys cannot reliably meet Commission requirements in urban, dense urban and indoor environments.[5] Although AFLT is based on TDOA measurements of network signals, this technology is inferior to U-TDOA. AFLT relies on the mobile handset to make these measurements. The capability of the handset to perform extensive signal processing is dramatically less than that of U-TDOA, where dedicated receivers and signal processors are deployed solely for the purpose of location.

The signal processing gain of U-TDOA dramatically exceeds that of AFLT, providing significantly better sensitivity to allow for more TDOA measurements. The increased sensitivity of U-TDOA provides an average of three times as many TDOA measurements as AFLT under the same conditions, resulting in dramatically better yield and accuracy compared to AFLT.

This conclusion is verified by test data. TruePosition's U-TDOA solution for CDMA has been tested extensively. One test conducted in a major city included a large number of carefully-defined scenarios, including calls made from inside high rise buildings. These indoor calls were

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[5] *See* Comments of Verizon Wireless at 17-20. *See also* Comments of Sprint Nextel at 11; Comments of Qualcomm at 5.

placed on the ground flood, mid floor, and top floor of numerous buildings, where on each of the floors the test locations were evenly distributed between locations near windows, interior room locations, and locations at the core of the building. The results of the test showed U-TDOA to be compliant with the requirements for a network-based solution in the most challenging dense urban and indoor areas in the U.S. Even with 50 percent of the calls placed from indoors, the system was compliant with the requirements for a network based solution.

In the 2000-2001 timeframe, the same U-TDOA product for CDMA was tested in a smaller city and its suburbs, in a suburban area, and across a very large rural area with 10 mile to 20 mile cell site spacing with similar results. These test results are shown in Table 3.

Table 3

Test area	67^{th} percent Accuracy (m)	95^{th} percent Accuracy (m)	Comment
Large City	96	204	Dense urban 50 percent outdoor, 50 percent indoor
Suburban	44	200	Suburban outdoor
Smaller City	46	145	Urban/suburban outdoor
Rural	48	188	Rural outdoor

A U-TDOA for CDMA system deployed today would have the following benefits over the system deployed in 2000-2001: Cell site densities have more than doubled in most areas, improving accuracy for U-TDOA by approximately 30 percent; wider bandwidth signals are in use in many cases today, improving the accuracy of the U-TDOA by an additional 30 percent when the wideband signals are used; the U-TDOA location can be hybridized with A-GPS to provide dramatically better accuracy in suburban and rural areas; and additional signal

processing power can be applied to the location due to advances in computer hardware. Based on these changes, a hybrid U-TDOA + A-GPS solution for CDMA would easily meet a 100 meter 67 percent, 300 meter 95 percent accuracy requirement in virtually all PSAPs, and would meet a 50 meter 67 percent, and 150 meter 95 percent accuracy requirements in the vast majority of PSAPs.

U-TDOA technology is the solution to the problems in urban, dense urban, and indoor environments suggested by CDMA operators.[6] Because the CDMA operators chose AFLT + A-GPS as their E911 solution, TruePosition discontinued its support of U-TDOA for CDMA and has been focused for several years on location of GSM phones. To support UMTS mobile phones which utilize CDMA, TruePosition is developing a CDMA-capable U-TDOA product. The hardware for the product will be ready for deployment in 12 months, and can be software upgraded to support U-TDOA + A-GPS hybrid location for CDMA in 18 months. Based on TruePosition's experience in deploying U-TDOA technology for over 75,000 cell sites, U-TDOA + A-GPS hybrid could be deployed across the urban and suburban areas of the CDMA operators within 3 years.

C. Other Technologies Are Not Capable of Producing Significant Improvements

1. A-GPS

Along with network based technologies such as U-TDOA, Cell ID, and Cell ID + Timing advance, TruePosition also provides A-GPS technology. The experience TruePosition has gained with these technologies confirms the theoretical conclusions derived from physics. Technologies other than the U-TDOA + A-GPS hybrid are not capable of producing the desired improvements in location estimates.

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[6] *See supra* n. 4.

TruePosition hired a third party to test A-GPS in a major Midwestern city in December, 2006. This test included dense urban, urban, suburban, and rural areas as defined below, with calls placed in both indoor and outdoor locations.

Table 4 summarizes the results.[7]

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[7] The test areas were defined as follows:

Dense Urban: Typically downtown environments in larger urbanized cities where high-rises and skyscrapers on sides of 1 to 3 lane streets are observed. Urban canyons are commonly encountered. Very high cell site concentration is also observed. Cell site radii are generally under half a mile.

Urban: High population density where multi-story apartment and office buildings are observed. Some buildings as high as 10 to 15 stories situated on 2 to 4 lane roads outline the environment. High site concentration due to capacity requirements and higher signal penetration margins are encountered. Cell radii are typically in the 0.5 – 1 mile range.

Suburban: Medium population density with 1-2 story residential homes, occasional 2-3 story buildings and multi-level shopping centers. Area is typically covered by a few cell sites. Cell site radii are typically in the 1 – 2 mile range.

Rural: Sparsely populated geographical area with much open or forested space.

Majority of area is covered by one cell site. Cell radii are generally more than 2 miles.

Cell deployments along sparsely populated highways which have sites 4 or more miles apart belong to this category.

Indoor: Since an Indoor setting can range widely in its impact on wireless operation depending on the structures, it is defined via the following subclasses:

Low penetration loss: 1 or 2 story house or building made of wood or brick surrounded by similar buildings, series of townhouses or stores in residential walking area, or in or near a strip shopping mall.

High penetration loss: Underground parking lots of shopping centers, inside elevator, and inner offices of high rise buildings.

Table 4

Metric	Metric Definition	Rural Outdoor	Suburban Outdoor	Urban Outdoor	Dense Urban Outdoor	Indoor Low Penetration	Indoor High Penetration
Accuracy 67 percent (m)	67th percentile error in meters	14	20	25	8995	67	a
Accuracy 95 percent (m)	95th percentile error in meters	80	284	b	b	1000	b

a -- indicates that the technology failed to produce a location more than 33 percent of the time, preventing a 67th percentile accuracy from being computed.

b -- indicates that the technology failed to produce a location more than 5 percent of the time, preventing a 95th percentile accuracy from being computed.

Based on these results, it is clear that A-GPS location technology alone is not an acceptable solution for E911. The technology performs well when there is an unobstructed view of the satellites, such as rural and suburban outdoor areas, and the technology even performs well in some indoor scenarios, such as wood framed homes. The technology does not perform reliably in areas where the view of the sky is significantly obstructed, such as in urban areas, dense urban areas, or areas inside buildings made of concrete, steel and glass. These types of buildings are found not only in urban areas, but also in suburban areas with significant frequency in the form of shopping malls, stores, schools, and apartments. The results of this testing are consistent with statements made by Verizon and Qualcomm in their filings based on wider

experience with A-GPS technology capabilities.[8] A-GPS is a good technology in the areas where it works. Unfortunately, it does not work in key areas where many E911 calls are placed, in urban areas and indoors. Indoor performance is key. As Professor Dale Hatfield recently told the Senate Commerce Committee:

> The fact that GPS signals come from far out in space means that that they are typically much weaker than the signal arriving at the handset from a nearby cellular tower. The result is that a cellular subscriber may be able to successfully complete a 9-1-1 call from within the building while, in contrast, the satellite signals are too few or too weak to allow an accurate position fix to be obtained. That is, you can complete the call but you cannot be automatically located. If it is true that as many as 40-60 percent of all cellular calls are made indoors--from an office, home, sports arena, restaurant, airport or whatever, then it follows that a corresponding percentage of test calls should be made from such locations. I do not believe that this is the case today.[9]

2. A-GPS + AFLT

The A-GPS + AFLT hybrid is a technology used by IS-95/CDMA 2000 operators in North America.[10] This helps overcome the problems experienced with A-GPS due to visibility issues with the satellite signals In CDMA 2000 networks, the solution has an advantage due to the fact the base stations are synchronized. This allows the mobile phones to be provided fine timing assistance data, which improves sensitivity, reduces time to first fix, and can also reduce the cost of implementation of A-GPS in the mobile handset.

The A-GPS + AFLT hybrid was tested in the same Midwestern city, at the same time and in the same places, as the A-GPS solution. This hybrid solution provides significant improvement over the A-GPS solution alone, as can be seen comparing the results in Table 5 with those in Table 4. With AFLT, the hybrid solution worked more reliably in low penetration

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8 *See* Comments of Verizon Wireless at 17-20; Comments of Qualcomm at 5.

9 Testimony of Dale N. Hatfield, Hearing on "Voice over Internet Protocol (VOIP) and the Future of 9-1-1 Services," Senate Committee on Commerce, Science, and Transportation, April 10, 2007.

10 For description of the technology, *see* Comments of Verizon Wireless at 16-22.

buildings, but still failed to perform in dense urban areas and in buildings made of concrete, steel, and glass. The 95th percentile performance of AFLT + A-GPS in rural areas, which shows poor yield, is likely a testing anomaly. TruePosition is confident that A-GPS +AFLT can perform well in rural areas.

Table 5

Metric	Metric Definition	Rural Outdoor	Suburban Outdoor	Urban Outdoor	Dense Urban Outdoor	Indoor Low Penetration	Indoor High Penetration
Accuracy 67 percent (m)	67th percentile error in meters	23	19	30	368	48	a
Accuracy 95 percent (m)	95th percentile error in meters	b (should perform well)	104	246	1989	980	b

a -- indicates that the technology failed to produce a location more than 33 percent of the time, preventing a 67th percentile accuracy from being computed.

b -- indicates that the technology failed to produce a location more than 5 percent of the time, preventing a 95th percentile accuracy from being computed.

As the test demonstrates, an A-GPS + AFLT hybrid is not adequate for dense urban areas, or inside concrete, glass, and steel buildings. TruePosition does not have specific A-GPS or A-GPS + AFLT test data with respect to performance under trees. In general, our test results correspond with Verizon Wireless' statements about A-GPS + AFLT.

III. TESTING PROCEDURES

The mobile wireless industry is one of the most dynamic in the U.S. economy. This reality is important for all of the Commission's regulations affecting the mobile business, including mandated changes to procedures for testing location accuracy. The rapid changes in which mobile services are presented to the public and in the manner in which the public consumes them counsel that the Commission's regulations describe ends rather than means in the realm of accuracy testing. If the regulations become excessively detailed, they will risk rapid obsolescence, and administrative law requirements inevitably will cause the process of making changes to be arduous and time-consuming. An obvious example should suffice to illustrate the concern: One of the most important changes in consumer behavior from the perspective of E911 is the growing incidence of indoor calls. When E911 regulations first were under consideration in 1994, only a remarkably far-sighted industry expert would have been able to predict this trend and only a remarkably far-sighted Commission would have configured testing regulations to accommodate it. With the recent and impending licensing of different spectrum blocks with different propagation characteristics (connoting changes in service production), and with the recent announcements of new types of service such as combined broadband PCS and WiFi (connoting changes in service consumption), for example, it seems clear that perceptions of appropriate test protocols also will change.

In addition, as many of the firms filing comments in the first phase of this proceeding have observed,[11] testing is expensive for both PSAPs and industry. It may well be the case that relatively efficient, widely accepted approaches to testing will emerge and evolve. They should not be precluded by unnecessarily rigid rules.

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[11] *See*, *e.g.*, Comments of United States Cellular at 3-5; Comments of Sprint Nextel at 12-14.

The experience with industry forums has been positive and is instructive with respect to how the testing protocols are likely to evolve in a cooperative industry-public safety environment. TruePosition has actively participated in ESIF, as well as the 7th Network Reliability and Interoperability Counsel ("NRIC VII"). TruePosition believes the methodologies proposed by ESIF for Accuracy Testing and Maintenance Testing functionality testing developed by E-911 stakeholders, including public safety, wireless carriers, and equipment manufacturers, offered a solid and effective approach to the achievement of consistent accuracy test results in the form of:

- High Level Requirements for Accuracy Testing Methodologies (ATIS-0500001)
- Maintenance Testing (ATIS-0500010)

TruePosition adopted and continues to follow test methodologies that closely resemble those described in the ESIF documentation.

TruePosition believes that, as reported by the NRIC VII Focus Group 1A report, accuracy testing should include a number of indoor locations that reflects the increasing volume of indoor wireless E911 calls. Stated more generally, testing should include the environments that reflect the actual emergency call usage patterns observed by public safety. Very importantly, this includes indoor environments and encompasses such variables as heavy or light construction which results in different radio frequency penetration losses. The NRIC report indicates a minimum of 5 percent of the test calls should be generated indoors; however, TruePosition believes that compliance testing should include a much larger percentage of test calls made indoors, properly weighted to reflect actual indoor wireless E911 usage.

In summary, the Commission's role in compliance testing should involve specifying broad parameters.[12] It should indicate how often accuracy testing should be undertaken and it should specify minimum quality standards in terms of confidence in the test results.

IV. TEST RESULTS

As a practical matter, if accuracy testing is to take place on a bi-annual or closer interval basis, many PSAPs will not have the resources or the expertise to determine whether the results are satisfactory. Generally, TruePosition believes that it would be more efficient to have the test results submitted to the Commission, and perhaps to a third party auditor selected and engaged by the national organizations representing public safety agencies. A centralized approach would permit a more consistent and, in general, more discerning review of compliance test results than approximately 6,000 separate reviews of drastically varying sophistication. It would permit comparisons of system performance within each testing period and over the course of multiple testing periods. Most important, it would enable a more reliable identification of outliers for follow-on investigation and, where appropriate, remedial efforts.

It is important not to underestimate the difficulty of this task. The circumstances of the country's approximately 6,000 PSAPs vary significantly. System compliance needs to be understood in terms of local conditions of, for example, mobile system design, population density, E911 calling patterns, topology, and cultural features. In addition, unless and until the Commission directly or indirectly mandates a common location technology and it is fully implemented, the relevant accuracy standards will vary. Notwithstanding these important

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[12] We believe the Commission also should be involved in evaluating accuracy test results. *See infra* Section IV.

differences, the practical consequences of mandating PSAP-by-PSAP testing will be larger and more beneficent if the review is centralized rather than fragmented.

This approach should not and will not leave the PSAPs out of the process if the Commission also mandates that the test results be made public. This step will enable those PSAPs with the budgets and other resources to make their own assessments, while sparing those that do not a futile effort. It also will let any interested party make use of the results as it wishes, including in selection or recommendation of a wireless carrier. In this sense, the accuracy testing would resemble automobile crash tests or EPA mileage estimates. They would form a basis for comparison for those who wish to make comparisons. Very importantly, although informal suasion would be available at the local PSAP level, the determination of whether remedial measures should be required would reside in a formal sense with the Commission, just as it does today. That is as it should be for reasons of expertise, but also to avoid the evident moral hazard that is inherent in E911 cost recovery mechanisms. Funds are assembled on a statewide basis, but applied on a local basis. If individual PSAPs are allowed to require additional investments in location accuracy by virtue of the changes the Commission is proposing in this docket, the risk of undisciplined, and perhaps legally-enforceable, demands for additional investments will be great. The way to prevent it, while securing desired improvements, is to have the Commission determine if the compliance test results warrant additional investment.

V. ROAMERS

The rationale for wireless E911 is stronger in the case of roamers than any other category of consumer. Normal PSAP protocol involves a request for location, even where automatic location estimates are presented to the public safety dispatcher. There is no question that the availability of location estimates is an important benefit in confirming the information provided by the person placing the 911 call. A fortiori, there is no question that it is an indispensable

benefit when the caller is unable to provide a correct response to the dispatcher's query about location. For obvious reasons, this is more likely to occur when wireless roamers are placing 911 calls than it is when residents of a locale are placing the calls. Location estimates should be provided for emergency calls placed over a network without regard to whether the subscriber's home network has a roaming agreement with the carrying network.

VI. SINGLE ACCURACY STANDARD

The issue of accuracy standards has posed difficulties for the E911 program from very early in its existence. The two standards the Commission has promulgated suffer from a common problem. It is not possible to maintain a one-size-fits-all standard *unless* it is measured on a very broad geographic basis, and even then it may not be achievable. TruePosition believes that the accuracy measurements in which it has participated have met the 100 meter/300 meter standard. Based on the guidance in OET-71, TruePosition has measured accuracy across its customers' networks. In some cases these networks are national and in others they are pronouncedly local. In addition, it has measured accuracy using a weighting factor that reflects the place of origin of 911 calls. Since these calls tend to occur more frequently in urban and suburban locations, and since TruePosition's U-TDOA technology works particularly well in these areas of population and cell site density, it has had little problem meeting the requirement.

Replacing the relatively relaxed geographic requirement with one that in some cases will be very constrained poses a much more difficult compliance obligation. It raises the question of whether the Commission should attempt to configure a more realistic, if admittedly more complicated, set of accuracy standards.[13] This question is integral to the present initiative if, as

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[13] Qualcomm raised a question about the commensurability of the existing network and handset accuracy standards in its initial comments. *See* Comments of Qualcomm at 6, n. 6. Adoption of a single accuracy standard for both network and handset technologies will have to resolve the existing discrepancy that 100

we assume, the proposed move to a PSAP-by-PSAP accuracy and testing regime is motivated by a desire to effect practical improvements in location estimates. It is self-evident that differences in terrain and cultural features lead to differences in the requirements confronting emergency services providers, a point suggested by Commissioner Adelstein's Concurring Statement.[14] Very precise estimates may be critical in some circumstances and superfluous in others. Ultimately, the specification of appropriate accuracy levels must remain with the Commission, but the determination should reflect the perceived needs of the PSAPs, the direct consumers of the location estimates.

The further question arises of whether there should be a single standard from the perspective of technology rather than PSAP need. If the Commission were to mandate an effective hybrid solution,[15] the issue would disappear once a transition -- which would take several years -- is accomplished. The clear tendency of the *Notice* is to do this, either directly or indirectly. If the Commission chooses this mandate, it is important that its administration of the requirement reflect the undoubted reality that there will be some, although relatively few, locations where it will remain unachievable.[16]

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percent of network calls *necessarily* are included in accuracy calculations, but only 95 percent of handset calls *necessarily* are included as a result of 47 CFR 20.18(g)(v).

[14] "As we look to new accuracy requirements, should we consider a topographic- or geographic-based standard to E911 that may better reflect the practicalities of trying to make a location determination in certain parts of the country? Should we consider population density or tower site density"? *Notice*, Statement of Commissioner Adelstein at 2.

[15] As a practical matter, the mandate of a particular hybrid solution could occur directly or indirectly--directly by specifying or rejecting particular technological approaches or indirectly by specifying a level of performance that can be achieved only by particular technologies.

[16] *See*, *e.g.*, Comments of Qualcomm at 2-7; Comments of Sprint Nextel at 11-12; Comments of Verizon Wireless at 2-3, 16-22.

If a hybrid technology is not mandated and the Commission seeks to apply accuracy standards at the PSAP level, it should maintain the existing standards. However, it should recognize that network-based technologies will not be able to meet the standard in many rural areas and that handset-based technologies will not be able to meet the standard in many urban areas.

VII. CONCLUSION

TruePosition's experience confirms that implementation of a hybrid U-TDOA + A-GPS technology would improve E911 location estimates. No other available technological approach is likely to meet PSAP-level accuracy requirements in the vast majority of cases..

Respectfully Submitted,

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